C-3045

Claims

1. A unitary manifold assembly for use in controlling the flow of reactant gas streams between a plurality of fuel cell stacks in a fuel cell power plant, said manifold assembly comprising a fuel gas passage having a plurality of fuel gas inlets for selective connection to a plurality of fuel cell stacks in a first stage of power plant fuel cell stacks, said fuel gas passage being operative to receive partially expended fuel gas streams exhausted from said plurality of fuel cell stacks and to combine said partially expended fuel gas streams into a combined fuel gas stream, and said fuel gas passage having a fuel gas outlet for directing the combined fuel gas stream to at least one second stage power plant fuel cell stack whereby the combined fuel gas stream is used to provide fuel for the second stage power plant fuel cell stack, the first and second fuel cell stack stages forming at least a part of a power section of the power plant.

2. The manifold assembly of Claim 1 further comprising a fuel gas exhaust passage for operative connection with fuel cell stacks in said second stage thereof, a fuel gas exhaust passage including a fuel gas inlet for receiving spent fuel gas from the fuel cell stacks in said second stage, and a fuel gas outlet for exhausting spent fuel gas from the power section of the power plant.

3. The manifold assembly of Claim 1 further comprising at least two separate air reactant flow passages one of which is an air reactant inlet flow passage, and another of which is an air reactant outlet flow passage, said air reactant inlet flow passage having a plurality of outlets which are operatively connectable to separate ones of the fuel cell stacks in the power plant power section so as to direct air into each of the separate fuel cell stacks in the power plant power section, and said air reactant outlet flow passage having a plurality of inlets which are operatively connectable to separate ones of the fuel cell stacks in the power plant power section, whereby said air reactant flow passages are operative to direct an air reactant stream into and out of each of the fuel cell stacks in the power section of the power plant in parallel fashion.

4. The manifold assembly of Claim 3 wherein a single air inlet chamber is operatively connected with said air reactant inlet flow passage so as to direct a stream of air to said air reactant inlet flow passage.

5. The manifold assembly of Claim 1 wherein said manifold assembly is formed from thermoformed components.

6. The manifold assembly of Claim 5 wherein said manifold assembly is formed by twinsheet thermoforming.

7. The manifold assembly of Claim 1 wherein said fuel gas passage is sized so as to provide approximately equal distribution of fuel to each fuel cell stack in the at least one second stage power plant fuel cell stack and minimize pressure drop through the fuel gas passage so as to minimize back flow of the fuel gas stream in the fuel gas passage.

8. The manifold assembly of Claim 1 wherein said manifold assembly is provided with alignment means for fixedly aligning the fuel cell stacks relative to said manifold assembly fuel gas and air passages.

9. A fuel cell power plant power section assembly comprising:
a) a plurality of fuel cell stacks, said fuel cell stacks being being divided into at least two stages which are provided by a fuel gas stream in tandem with partially spent fuel from one stage being fed into a subsequent stage, said one stage including a plurality of fuel cell stacks, and said subsequent stage including at least one fuel cell stack; and
b) a unitary manifold assembly for use in controlling the flow of reactant gas streams between said plurality of fuel cell stacks in said one and said subsequent fuel cell stack stages, said manifold assembly comprising a single fuel gas passage operatively connected to said plurality of fuel cell stacks in said one stage of said fuel cell stacks, said fuel gas passage being operative to receive partially expended fuel gas streams exhausted from said plurality of fuel cell stacks and to combine said partially expended fuel gas streams into a combined fuel gas stream, and said fuel gas passage also being operatively connected to said at least one fuel cell stack in said subsequent stage for directing the combined fuel gas stream to said least one fuel cell stack in said subsequent stage, whereby the combined fuel gas stream is used to provide fuel for the subsequent stage fuel cell stack.

10. The power section assembly of Claim 9 wherein said manifold assembly further comprises a single fuel gas stream outlet passage which is operatively connected to said at least one fuel cell stack in said subsequent stage and is operative to channel spent fuel gas from said at least one fuel cell stack in said subsequent stage to remove the spent fuel gas from said power section assembly.

11. The power section assembly of Claim 9 wherein said manifold assembly further comprises a single air reactant stream inlet passage and a separate single air reactant stream outlet passage, said air reactant stream inlet passage being operatively connected to each of the fuel cell stacks in each stage of said power section assembly and operative to direct the air reactant into each of said fuel cell stacks in said power section, and said air

reactant stream outlet passage being operatively connected to each of the fuel cell stacks in each stage of said power section assembly and operative to receive the air reactant exhausted from each of the fuel cell stacks and duct the air reactant exhaust from said power section.

12. The power section assembly of Claim 11 wherein said manifold assembly further comprises an air inlet chamber operatively connected to said single air reactant inlet passage so as to direct a stream of air to said air reactant inlet passage.

13. The power section assembly of Claim 9 wherein said manifold assembly is formed from thermoformed components.

14. The power section assembly of Claim 13 is formed by twinsheet thermoforming.

15. The power section assembly of Claim 9 wherein said single fuel gas passage is sized so as to provide approximately equal distribution of fuel to each fuel cell stack in said subsequent fuel cell stack stage and minimize pressure drop through the fuel gas passage so as to minimize back flow of the fuel gas stream in the single fuel gas passage.

16. The power section assembly of Claim 9 wherein said manifold assembly is provided with alignment means for fixedly aligning the fuel cell stacks relative to said manifold assembly fuel gas and air passages.

17. A method for providing a fuel gas reactant and an air reactant to a multistage fuel cell power plant power section which power section includes a first fuel cell stack stage having a plurality of fuel cell stack assemblies, and a subsequent fuel cell stack stage having at least one fuel cell stack assembly, said method comprising the steps of:
a) providing a one piece reactant transfer manifold assembly which is operatively connected to each of the fuel cell stacks in the power plant power section;
b) directing streams of a fuel gas into each of the fuel cell stack assemblies in the first fuel cell stack stage; and
c) combining partially spent fuel gas streams from each of the fuel cell stack assemblies in the first fuel cell stack stage into a single fuel gas stream in the transfer manifold, and directing the combined single fuel gas stream through a single fuel gas passage in the transfer manifold to the at least one fuel cell stack assembly in the subsequent fuel cell stack stage so as to provide a fuel gas stream for the subsequent fuel cell stack stage.

18. The method of Claim 17 comprising the further steps of directing air reactant streams through a single air reactant inlet passage in said reactant transfer manifold into all of the fuel cell stack assemblies in the power section; and removing air reactant streams from all of the

fuel cell stack assemblies in the power section through a single air reactant outlet passage in said reactant transfer manifold .